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Amendment under 37 CFR §1.116
Application No. 10/551,432
Attorney Docket No. 053087

REMARKS

Rejections under 35 USC §103(a)

Claims 3, 4 and 9-14 are rejected under 35 USC §103(a) as being unpatentable over Hirozawa et al (JP 62-074048) and Kaino et al (JP 01-117303) in view of Kadokura et al (USP 4,784,739) and Nishiuchi et al (USP 6,861,089).

Independent claims 3 and 9 have been amended. The amendments are supported in the specification at pages 13 and 14.

Amended claims 3 and 9 both recite the step of "forming a cylindrical or disc-shaped rare earth magnet with a hole forming an inner surface, wherein the magnet has a surface to volume ratio of 2 mm^{-1} or more and a volume of 100 mm^3 or less, the forming step including a step of applying mechanical processing to a sintered Nd-Fe-B system or Pr-Fe-B system rare earth magnet block material so as to damage the surface of the magnet and to cause a magnetic characteristic $(BH)_{max}$ of the magnet to deteriorate."

As described in the present specification, small cylindrical Nd-Fe-B sintered magnets having an external diameter of about 2 mm are used for small motors such as vibration motors for cellular phones. Those small magnets are manufactured by mechanical working such as cutting, drilling, grinding and polishing on a sintered magnet block. Such mechanical working alters and damages the surface layer of the magnets to significantly deteriorate the magnetic properties. Thus, it was difficult to realize a further smaller size motor without lowering the power.

Amendment under 37 CFR §1.116
Application No. 10/551,432
Attorney Docket No. 053087

The present invention solves such problems of conventional technologies as mentioned above, and to obtain a high performance rare earth permanent magnet, in particular, a small volume rare earth permanent magnet. The present inventors succeeded in developing a small and high performance rare earth permanent magnet whose original magnetic properties are restored and can be used for micro applications.

To achieve the objective, it is important how the small magnet is held in order to homogeneously coat R metal on the surface of the magnet. Claim 3 recites the following steps: **"inserting an electrode wire into the hole of the cylindrical or disc-shaped magnet, supporting the magnet on the electrode wire in a depressurized tank, placing the electrode wire between oppositely-disposed targets in the tank, wherein the oppositely-disposed targets are ring-shaped targets disposed concentrically with respect to the center axis of the cylindrical or disc-shaped magnet, reverse-sputtering the magnet while the magnet is made to be electrically negative through the electrode wire, transforming an R metal (R denotes at least one kind of rare earth elements selected from the group consisting of Y, Nd, Dy, Pr, Ho and Tb) or an alloy containing an R metal into fine particles by a sputtering method, rotating the magnet with the electrode wire as a rotation shaft, allowing the fine particles to fly three-dimensionally and deposit to form uniform film onto the whole or part of the surface of the magnet, allowing the film to diffuse and permeate from the surface of the magnet to the inside of the magnet to at least a depth corresponding to a radius of a grain exposed on the outermost surface of the magnet."**

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Application No. 10/551,432

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Also, claim 9 recites the following steps: "loading the magnet in a wire basket to be freely tumbled, placing the wire basket in a depressurized tank, vaporizing an R metal (R denotes at least one kind of rare earth elements selected from the group consisting of Y, Nd, Dy, Pr, Ho and Tb) or an alloy containing an R metal in the depressurized tank by physical means, allowing the R-metal vapour to fly three-dimensionally and deposit to form uniform film onto the whole or part of the surface of the magnet, allowing the film to diffuse and permeate from the surface of the magnet to the inside of the magnet to at least a depth corresponding to a radius of a grain exposed on the outermost surface of the magnet.

Thus, the quality of the damaged magnet surface a portion is improved so that the magnetic characteristic $(BH)_{max}$ is recovered to 280 kJ/m³ or more.

Hirozawa et al, Kaino et al, Kadokura et al and Nishiuchi et al do not teach or suggest the particular combination of the steps as recited in claims 3 and 9.

For at least these reasons, claims 3 and 9 patentably distinguish over Hirozawa et al, Kaino et al, Kadokura et al and Nishiuchi et al. Claim 4, depending from claim 3, and claims 10-14, depending from claim 9, also patentably distinguish over Hirozawa et al, Kaino et al, Kadokura et al and Nishiuchi et al for at least the same reasons.

Claim 8 is rejected under 35 USC §103(a) as being unpatentable over Hirozawa et al (JP 62-074048) and Kaino et al (JP 01-117303) in view of Kadokura et al (USP 4,784,739) and Nishiuchi et al (USP 6,861,089) as applied above and in further view of Kamiya et al (JP 2000-319778).

Amendment under 37 CFR §1.116
Application No. 10/551,432
Attorney Docket No. 053087

Claim 8 depends from claim 3. Kamiya et al is cited for allegedly disclosing ring-like targets in a sputtering process. Such disclosure, however, does not remedy the deficiencies of Hirozawa et al, Kaino et al, Kadokura et al and Nishiuchi et al.

For at least these reasons, claim 8 also patentably distinguishes over Hirozawa et al, Kaino et al, Kadokura et al, Nishiuchi et al and Kamiya et al.

Claims 15 and 16 are rejected under 35 USC §103(a) as being unpatentable over Hirozawa et al (JP 62-074048) and Kaino et al (JP 01-117303) in view of Kadokura et al (USP 4,784,739) and Nishiuchi et al (USP 6,861,089) as applied above and in further view of Makita et al (JP 2001-135511).

Claim 15 depends from claim 9, and claim 16 depends from claim 3. Makita et al is cited for allegedly disclosing the rare earth magnet coated with an anticorrosion covering wherein the surface area of S mm² and volume V mm³ are variable and the surface to volume ratio (S/V) ranges from 1-50 mm⁻¹ in order to prevent the degradation of the magnetic properties of said magnet. Such disclosure, however, does not remedy the deficiencies of Hirozawa et al, Kaino et al, Kadokura et al and Nishiuchi et al.

For at least these reasons, claim 8 also patentably distinguishes over Hirozawa et al, Kaino et al, Kadokura et al, Nishiuchi et al and Makita et al.

Amendment under 37 CFR §1.116
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In view of the aforementioned amendments and accompanying remarks, Applicants submit that the claims, as herein amended, are in condition for allowance. Applicants request such action at an early date.

If the Examiner believes that this application is not now in condition for allowance, the Examiner is requested to contact Applicants' undersigned attorney to arrange for an interview to expedite the disposition of this case.

If this paper is not timely filed, Applicants respectfully petition for an appropriate extension of time. The fees for such an extension or any other fees that may be due with respect to this paper may be charged to Deposit Account No. 50-2866.

Respectfully submitted,

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